

DELL

General Education Common Graded Assignment: *ERSC 101 SPRING 2020*
Calculating the Epicenter of an Earthquake = 20 points

ERSC 101 is a general education course designed to assist students in the development of critical life skills. One of the goals of this assignment is to assess student competence for each of these objectives:

- **Written and Oral Communication:** present Earth Science information using written and/or oral communications;
- **Critical Analysis and Reasoning:** analyze and present earth science data numerically and graphically;
- **Technological Competence:** use technology to gather data or research topics and/or problems;
- **Information Literacy:** locate, evaluate, use and document appropriate informational sources to research earth science topics;
- **Scientific and Quantitative or Logical Reasoning:** interpret Earth Science data using mathematical methods;

In addition to the above general education objectives, this assignment assesses students' understanding and application of the following skills and knowledge specific to *Calculating the Epicenter of an Earthquake*

- Destructive geological process affecting the landscape
- Earth cycles and materials

ASSIGNMENT AND SPECIFICATIONS:

Finding the Epicenter of an Earthquake

The purpose of this activity is for you, the student, to use seismic data to calculate the distance from three different seismic stations to the epicenter of an earthquake and to plot the derived data on a map in order to identify the latitude and longitude of the earthquake. The student will subsequently summarize their findings in writing by responding to a series of questions designed to evaluate the student's understanding of the theory behind the calculation of an earthquake epicenter. In a final part of the activity, students will complete online research about the economic, cultural, environmental, and/or demographic impacts of a specific seismic event.

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Calculating the Epicenter of An Earthquake

Purpose:

Part I: The purpose of part one of this activity is to help you, the student, understand how the epicenter of an earthquake is determined by having you:

1. use seismic data to calculate the lag times between the arrival of P and S waves at 3 seismic stations;
2. use a time travel curve and your calculated lag times to determine the distance the P and S waves traveled to each of the stations and
3. plot the data on a map to determine the epicenter of the earthquake.

Part II: In part two of the activity, you will respond in writing to a series of questions designed to evaluate your understanding of the theory behind the calculation of an earthquake epicenter.

Part III: In part three of the activity, you will complete online research about a specific seismic event and then determine the date, time, magnitude, location as well as economic, cultural, environmental, and/or demographic impacts of the seismic event. You will summarize your findings in your own words and in essay format.

Background Information:

Because P waves travel faster than S waves, the P wave arrives at a seismic station ahead of the S wave. The lag time between the arrival times of the two waves is directly related to the distance that the waves travel. Therefore, applying the seismic information derived from seismometers and applying it to the time travel curve, one can determine the epicenter of an earthquake.

Instructions:

Your Instructor will assign you activities which will provide you with the background needed to complete this activity. For all sections of ERSC 101, you should:

1. Read the section on seismic waves in your text (Chapter 5 of The Good Earth.)
2. Participate in a classroom discussion ! on the properties of maps.
3. Participate in a classroom discussion about how to read the time travel curve.
4. Review the concepts of latitude and longitude.

5. Use the data for the October 13, 1995 earthquake to fill out the data table below. Be sure to label the units of measurement for arrival time, lag time and distance. In the data table below, enter the names of the three stations and the arrival times of the P and S waves for each of the stations. To determine the distance to the earthquake epicenter, you must calculate the lag time between the arrival of the P and S waves for the three stations for which you have data. The data are to be expressed in seconds. Express the lag time in a single unit of time. Enter your calculated lag times into the data table below. Be sure to express your lag time in the appropriate unit of measurement.

Station	P Wave	S Wave	Lag Time	Distance

6. Knowing the lag time, you can use or the time travel curve included in this assignment to determine the P and S waves travelled from the earthquake epicenter to each station. Enter the distance the P and S waves travelled to each station into the data table above. Be sure to express your distances in the appropriate unit of measurement. **This is your working copy, not to be submitted!** Print out a copy of the included map of the Pacific. Use a drawing compass and the scale at the bottom of the map to draw arcs/circles around each of the 3 stations. Each arc should have a radius equal to the distance the waves travelled to the station. The three arcs you draw should come close to intersecting. Determine the latitude and the longitude of your epicenter.

NOTE: There are reasons why your arcs may not intersect exactly. What could some of those reasons be? Think about some of the readings, tutorials and discussions you had in class.

7. After completing the lab, respond in writing to each of the following questions. Write complete sentences. Be sure to properly cite your sources in MLA 6 style.

What to Submit:

Fill out and turn in the form below.

Name:

Student ID:

Section:

Activity: Determining the
Epicenter of an Earthquake

I. Data Table:

Station (0 pts)	P Wave Arrival Time (0 pts)	S Wave Arrival Time (0 pts)	Lag Time (12 pts)	Distance (12 pts)

II. Responses to Questions

Use complete sentences in all of your answers.

1. Describe how this activity helped you to understand how the epicenter of an earthquake is determined.
2. What was the latitude and longitude of your earthquake?
3. What limitation was there to the data derived from the time travel curve that required that you draw circles around each station?
4. How many possible epicenters would there be if you had data from a single station only? Explain.
5. What was the minimum number of stations that you had to draw to locate the epicenter? Explain.
6. Why did the three circles not necessarily intersect (consider how you derived your data, the properties of maps and other factors)?
Be specific. Don't say things like math error or measurement error.

III. Research of a Seismic Event:

In several well-written, typed paragraphs of entirely your own words state the following:

- The date of the event
- The magnitude of the event
- The location of the event
- The impacts of the event. This synopsis of the event's impact should include a minimum of 4 of the following areas of impact:
 - its economic impact
 - its cultural impact
 - its sociological impact
 - its political impact
 - its demographic impact
 - its geological impact

GRADING:

- This assignment will account for 10% of the total course grade.
- See attached rubric for details about how your essay will be graded.

SUBMISSION GUIDELINES:

- Please submit TWO copies. One copy should include your student ID, course number and section; it should omit student and faculty names. The other copy should follow MLA style guidelines.

DATE

Materials Needed for Determining the Epicenter of the October 13, 1995 Earthquake

Station	P Wave	S Wave	Lag Time (seconds)	Distance (km)
Tokyo	7:30:20	7:39:10		
Manila	7:30:00	7:38:20		
Brisbane	7:24:00	7:27:20		





